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ABSTRACT

Trait-Treatment Interaction (TTI), a research method for observing experimental effects of treatments on subjects of different aptitudes and learning characteristics, is suggested as an effective evaluation tool to provide evaluators and educators in compensatory education programs with information about which program is best for different kinds of learners. The premise of TTI research is that different instructional conditions work best when matched with selected learner traits, with "trait" defined as any characteristic of the learner that increases or impairs his probability of success in a given treatment. The methodology of Trait-Treatment Interaction (TTI) as outlined provides an alternative of the dilemma of control groups; and a proposed evaluation design is presented using Campbell's terminology of invited-accepted, invited-rejected, and uninvited. To tap the interaction of learner characteristics with instruction, the invited-accepted are tested and blocked or grouped on relevant learner characteristics, and then, within each block, randomly assigned to a treatment. The goal of this TTI factorial design is to develop alternative instructional programs for compensatory education which produce optimal educational payoff among pupils assigned differently to these programs on the basis of learner characteristics. (CS)

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ANALYZING FOR INDIVIDUAL DIFFERENCES IN EVALUATING COMPENSATORY EDUCATION PROGRAMS

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ANALYZING FOR INDIVIDUAL DIFFERENCES IN EVALUATING COMPENSATORY EDUCATION PROGRAMS

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Research, Development, and Demonstration
Center in Education of Handicapped Children
Minneapolis, Minnesota

June 1974

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The University of Minnesota Research, Development and Demonstration Center in Education of Handicapped Children has been established to concentrate on intervention strategies and materials which develop and improve language and communication skills in young handicapped children.

The long term objective of the Center is to improve the language and communication abilities of handicapped children by means of identification of linguistically and potentially linguistically handicapped children, development and evaluation of intervention strategies with young handicapped children and dissemination of findings and products of benefit to young handicapped children.

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ANALYZING FOR INDIVIDUAL DIFFERENCES IN EVALUATING COMPENSATORY EDUCATION PROGRAMS

One important task of educational research is to formulate more precise ways in which instruction can be varied so as to fit individual differences in abilities and styles of learning. While the educator may devise generalized instructional treatments in pursuit of improved results, these generalized instructional treatments must be supplemented by a search for ways of adapting instruction to the individual. The importance of this issue is illustrated by the conclusion of many researchers that no single instructional method or process provides optimal learning for all students (Bloom, 1968; Cronbach, 1957, 1967; Gagne, 1967).

Most compensatory education efforts do not answer the question of prime importance, namely which kind of instruction is most appropriate for which kind of learner. The trait-treatment interaction (TTI) is a research method suggested by Cronbach (1957) and recently reviewed by Berliner and Cahen (1973) for observing experimental effects of treatments on subjects of different aptitudes and learning characteristics. An evaluation maximizing the relationship between individual differences and treatments effects, a trait-treatment interaction study, provides the evaluator and educator with information about which program is best for different kinds of learners even when a no-treatment control group is not employed. The premise of TTI research is that different instructional conditions work best when matched with selected

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learner traits, with "trait" defined as any characteristic of the learner that increases or impairs his probability of success in a given treatment. The goal of TTI research is to develop alternative instructional programs which produce optimal educational payoff among pupils assigned differently to these programs on the basis of learner characteristics.

Methodology of Trait-Treatment Interactions

A TTI study can be recognized by its methodology. To permit testing a TTI, a study should include a comparison of two or more alternative treatments for attaining a common set of objectives. Also included should be one or more measures of individual characteristics (personological characteristics) such as degree of hearing loss or anxiety.

After a systematic analysis of 90 research studies designed to permit a test of TTI, Bracht (1970) concluded that the selection of personological variables and the nature of the alternative treatments were the major factors which make possible the occurrence of TTIs. Bracht suggested that TTIs were more likely to occur when two different personological variables as opposed to levels of one variable had been included in the experimental design. One of these variables was judged to be highly associated with success in one treatment, and the other was judged to correlate substantially with success in the second treatment. Moreover, the correlation between the two personological variables should be moderately low or nonsignificant.

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The payoff of a TTI study is apparent when a significant disordinal interaction effect is obtained when the treatment lines with reference to a graph of cell means cross (see Figure 1). An ordinal interaction (Figure 2) is one where the treatment lines are also not parallel but they do not cross. When the treatment lines do cross, payoff is obtained by assigning subjects to different treatments on the basis of differences in aptitude or learner characteristics, here called the relevant personological variables.

Cronbach and Snow (1960) suggested that experimenters move beyond the alternative treatment being merely a minor modification of some original instructional program. They suggest developing different treatments such that one treatment relies heavily upon general ability while the other treatment, designed to attain the same objectives, relies less on general ability. Where these qualitatively different treatments were employed, it was more probable to obtain a significant disordinal interaction in which one treatment was better for one personological group of subjects and the other treatment more appropriate for the other personological subject group.

A proposed evaluation design incorporating trait-treatment interactions

It seems obvious to most educators and researchers that not all children respond to the same instructional treatment, and that programs oriented to the individual best facilitate educational growth. Yet in preschool education as well as in compensatory education, attempts have been made again and again to mold children to the traditional one-track educational system which subjects all children

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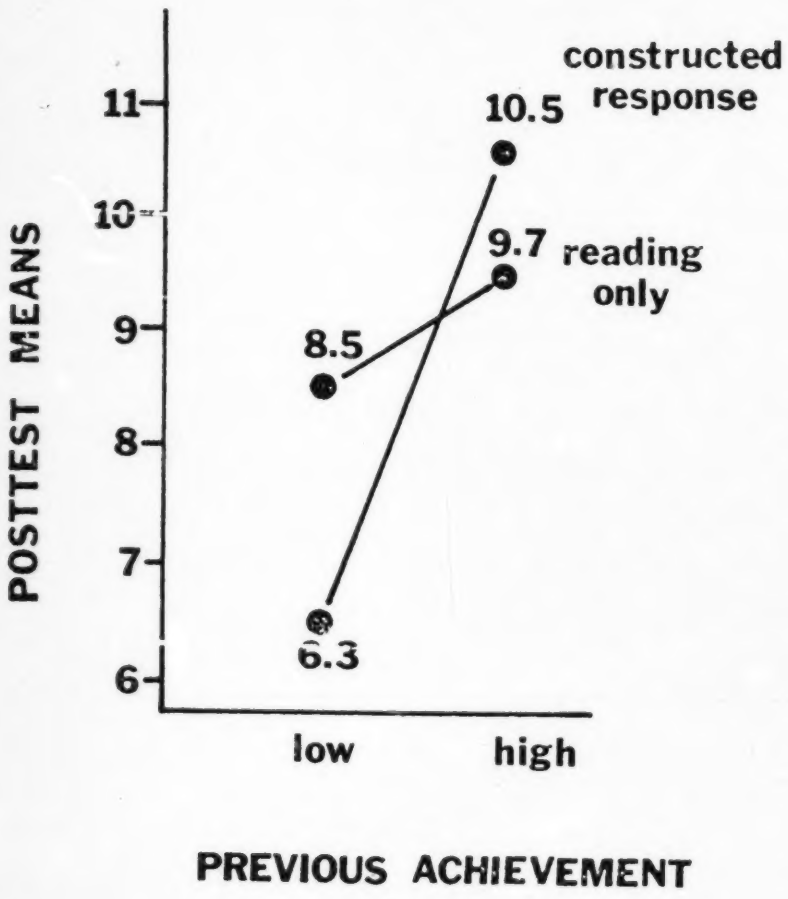

Figure 1. An example of a significant disordinal interaction from Bracht (1970).

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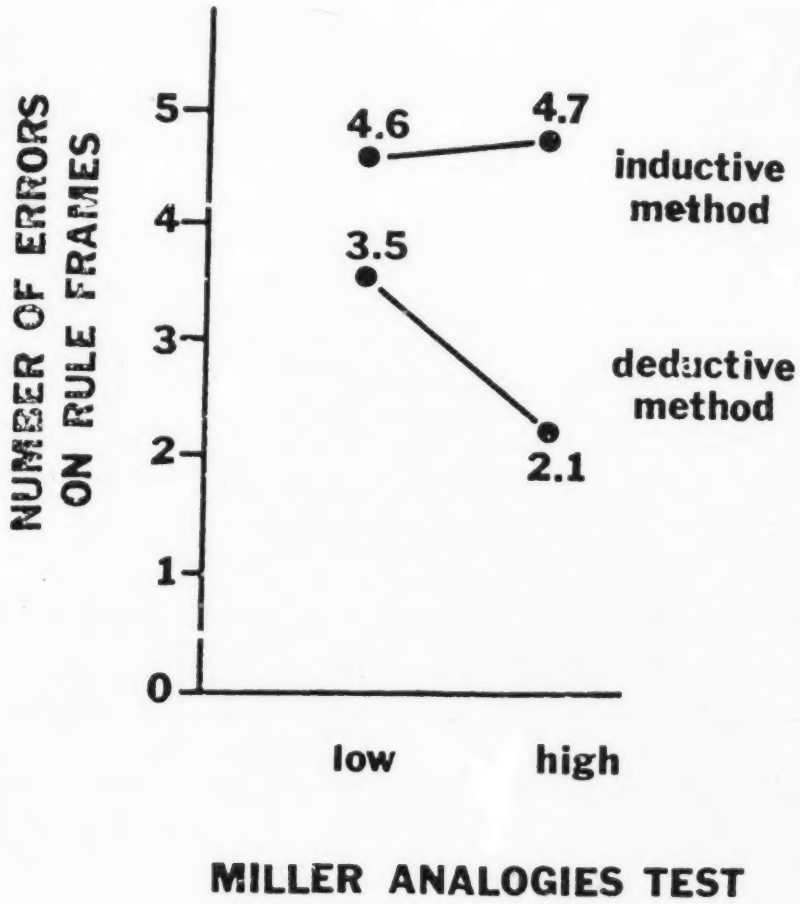

Figure 2. An example of a significant ordinal interaction from Bracht (1970).

to a program which is appropriate only for some. Most educators despair of this promoting of the old one-track system, yet it has not been soundly rejected by preschool evaluators and planners. Evaluations of compensatory education efforts and other major ameliorative programs have been conducted in a predominantly quasi-experimental or ex post facto manner with little or no consideration of individual differences in response to instruction. Rossi (1969), Campbell & Erlebacher (1970), & Campbell (1971) suggest that not one of these programs has been adequately evaluated, and further, that there was no comparison of the appropriateness of different kinds of instruction for different kinds of learners. What usually happens is that the compensatory programs, consisting of one-track instruction, are made available to the most needy, and the "control group" is sought among untreated and generally more able children from the same community.

Then through legerdemain matching, covariance or partial correlation, these two dissimilar groups are compared as though magically similar! In this situation, the usual procedures of selection, adjustment and analysis produce systematic biases which actually make the compensatory program look deleterious. The question of "best for whom" is never answered because it has not been asked.

Taking into consideration the many practical limitations imposed on evaluation efforts, the obvious question is: "How does one conduct an evaluation program of large scope, a major societal amelioration program, particularly if one wishes to attend to the kinds of individual differences measured by a TTI strategy?"

At this time the most plausible solution to this dilemma seems to lie in conducting evaluation programs where subjects have been randomly assigned to experimental and control groups. This argument has been suggested by Campbell and Erlebacher (1970) and Campbell (1971).

True experiments involving random assignment of experimental units to treatments while providing for the more powerful and most generalizable statements about results are also the most difficult to arrange unless the subjects are prisoners or hospital inmates. Yet forced participation violates democratic principles. School administrators are notoriously reluctant to deny help to some of the most needy to provide for an adequate no-treatment control group. Although there are quasi-experimental designs which may be employed where randomization is not possible, one of the authors of the most well-known books on quasi-experimental design stated that "detailed consideration of specific cases again and again reinforces my belief in the superiority of true experiments" (Campbell, 1971, p. 15).

As an alternative to experimental or control situations, I propose a situation with at least two attractive experimental conditions such as two different preschool programs. Using Campbell's terminology of invited-accepted, invited-rejected and uninvited, the invited-accepted would be randomly assigned to all conditions including the no-treatment control. To tap the interaction of learner characteristics with instruction, the invited-accepted could be tested and blocked or grouped on relevant learner

characteristics, and then, within each block, randomly assigned to a treatment. This kind of factorial design including learner characteristic blocks would better facilitate interaction statements about which treatment is individually preferable. The ideal experiment would involve at least two plausible treatments and perhaps a no-treatment control group where all groups are randomly selected from each of the invited-accepted learner characteristic blocks. If pretest bias is suspected, another control group could consist of children invited and parent accepted, excluding a pretest and using only a posttest, at which time the personological measure could be administered to facilitate trait-treatment interaction statements. Children who were uninvited because of being more able (e.g., of a higher socioeconomic status) would be an entirely invalid control group, covariance notwithstanding.

In case an innovation is in short supply (such as a pilot compensatory program), the invitation could advertise randomization as the most democratic means of distributing benefits among eligible participants. It might also be possible to stipulate on the invitation that although some subjects may be in a no-treatment control group one year, they can be assured of entry into the program the following year. One could then compare children who received the preschool program at either age three or four, and those who received it for both years three and four.

In most cases it is not enough to block children by location, race or socioeconomic status, or general ability and I.Q., as these factors may not have enough explanatory power. More relevant blocking

variables include preferred learning strategy, strongest perceptual modality, receptive or expressive abilities, introversion-extroversion and other similar constructs. Now is the time for applied program administrators to incorporate into their programs the results of "pure" experimental research. The trait-treatment interaction paradigm presents the framework to apply pure experimental research while attending to individual differences in response to instruction.

During this procedure it is important to fit learner characteristics and instructional treatments into a comprehensive, theoretical structure that logically and empirically relates the interrelationships among treatments and individual differences. Perhaps what is most efficacious is a multivariate analysis of the domain. This permits tentative hypotheses about the nomological net followed by controlled experimentation and multivariate prediction techniques to coalesce the data world and the nomological net and give direction to the logical and empirical relationships to be sought between hypothetical constructs.

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